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Polydiacetylene Supramolecules in Electrospun Microfibers: Fabrication, Micropatterning, and Sensor Applications**

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The generation of functional supramolecular structures through the self-assembly of small molecules continues to be a significant scientific endeavour.[1] Molecularly assembled monomers that contain polymerizable units often serve as precursors to unique supramolecular structures that have meritorious features, for example, enhanced stability and chromogenic functions. In this regard, polydiacetylene (PDA) supramolecules, readily prepared by UV or γ irradiation of molecularly assembled diacetylene (DA) monomers, are attractive substances.[2,3] The polymer backbone of PDAs consists of alternating alkene–alkyne structures. Owing to their intriguing stress-induced chromic transition (blue to red) and nonlinear optical properties, PDAs have been extensively investigated as potential chemosensors and photonic materials.[4]

Recently, the embedment of PDA supramolecules in matrices and host molecules has been used advantageously for the creation of well-defined nano- and microscale structures and substances with unique optical, electronic, and mechanical properties. Several examples include helical tubular inorganic architectures that are prepared by using a chiral diacetylene monomer as a template molecule,[5] PDA-silica nanocomposites that possess hexagonal, cubic, and lamellar structures,[6] and hybrid sol-gel matrices with encapsulated antibody-containing PDAs for biosensor applications.[7] The encapsulation of PDA supramolecules in polymer nano- or microfibers has not yet been reported.

Electrospinning has proven to be an efficient method for the formation of long polymer fibers with diameters in the range of nanometers to several micrometers.[8] In this technique a high voltage is applied to a conductive capillary, which is attached to a reservoir containing a polymer solution. A charged polymer jet is ejected from the surface of the polymer solution when the charge imbalance exceeds the surface tension of the polymer solution. Polymer fibers are formed when the jet stream, driven by electrostatic forces, moves to the grounded screen collector. Its characteristic merits allow the electrospinning technique to be uniquely applied to the rapid, cost-effective fabrication of PDA conjugated polymers in the form of microfibers with a large surface area. In this Communication we describe a simple but elegant approach for the generation of polymer microfibers containing embedded PDA supramolecules, based on the electrospinning technique.

The strategy employed in this study, schematically presented in Figure 1, initially involves DA monomers that are randomly distributed in an organic solvent before electrospinning. As the solvent evaporates during fiber formation, self-assembly of DA monomers takes place because the attractive forces between the DA monomers are larger than those between the DA monomers and matrix polymers. Polymerization of the self-assembled DA monomers should result in the formation of PDAs embedded within the polymer fibers. 10,12-Pentacosadiynoic acid (PCDA, $CH_3(CH_2)_{11}C{\equiv}C$–$C{\equiv}C(CH_2)_8COOH$), a frequently employed DA monomer in

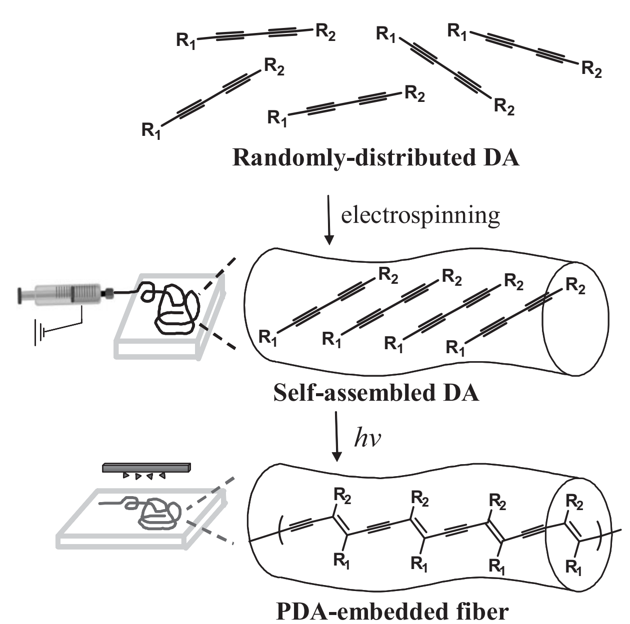

Figure 1. Schematic representation of the preparation of polymer microfibers-embedded with PDA supramolecules by using the electrospinning technique, followed by irradiation with UV light (254 nm).

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